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Study on human-macaque conflict in the Hosanagara taluk of Shivamogga district, Karnataka

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ABSTRACT

The bonnet macaque (*Macaca radiata*) is one of the intelligent, adaptive creatures, it is becoming increasingly difficult to prevent their entry into agricultural lands, and although several unique measures have been conceived to deter them from raiding the crops, the monkeys have invariably found a way around them. To quantify the conflict situation associated with this animal, the study was carried out in Hosanagar Taluk of Shimoga district during April 2016 to March 2017. The villages within this taluk being largely agriculture-dependent, and the forest area being vast enough that three forest ranges pass through it, humans and wildlife come in contact with each other on a regular basis. The objective behind the study was to document and quantify the impact of the man-monkey conflict in the area, to determine the possible causes of the conflicts and to encourage management to take steps that would reduce the severity and frequency of future conflicts. Data was collected by questionnaire survey and direct observation. Most of the farmers interviewed own less than 10 acres of farmland (76.19%), with only a few having more than 10 acres (23.80%). The maximum area of land owned is 27 acres, with 1 acre being the minimum. Farmers have come up with several techniques to keep monkeys from raiding their crops. Of these, the most commonly employed measure is the use of dogs (90.47%). At least one dog was observed in nearly every household. Nets or fencing (85.71%) and/or Ibex fences (66.66%) are set up by all respondents as they serve the dual purpose of keeping animals away and acting as a boundary. The other methods of chasing away monkeys involve use of stones and loud sounds. Guns are the least common, owned by only 19.04% of the respondents. Approximately 86% of the respondents viewed the macaques as pests, and about 38% considered them to be sacred. Most of the people in this group had a mixed opinion of the monkeys, considering them to be god, but the loss they incur leading them to believe they are also pests. Very few of the people interviewed (9%) felt that the monkeys were harmless and that the issue was manageable on their farms. The human and bonnet macaque conflict situations such as crop damage, house raids, infrastructure damage and Aggressive behaviour was recorded and mitigation methods, possible causes for the conflict, official perspective and over all opinion elucidated in detail.

Key words: Human-monkey conflict, Plantation crops, bonnet macaque.

INTRODUCTION

Conflict is a word that has more implications than it suggests. If the term is used to address any interaction between man and animal, it may result in the situation truly deteriorating into a conflict issue. For this reason, it is necessary to determine whether conflict exists before classifying it as such. This is especially true of non-human primates as perception of these creatures vary from one extreme to the other. In certain cultures they are considered sacred beings, while to others they are viewed as pests.

The farmers in certain areas have grown used to the constant presence of these macaques, considering it a manageable issue and therefore, not a conflict situation. However, others that are solely dependent on agriculture for their livelihood or where the monkeys have developed bolder tendencies and therefore present more of a challenge – they are the people who are becoming more and more frustrated with the toll on their crops caused by these animals (Lee & Priston, 2005). The bonnet macaque (*Macaca radiata*) is one of the greatest proponents of this conflict (Sharma et al., 2010). Being the intelligent, adaptive creatures they are, it is becoming increasingly difficult to prevent their entry into agricultural lands, and although several unique measures have been conceived to deter them from raiding the crops, the monkeys have invariably found a way around them (Lee & Priston, 2005). People have now resigned themselves to chasing them away after their presence in the fields has been detected, which results in some level of economic loss. To quantify the conflict situation associated with this animal, the Kerehalli hobli within the Hosanagara taluk of Shimoga district was considered for study. The villages within this hobli being largely agriculture-dependent, and the forest area being vast enough that three forest ranges pass through it, humans and wildlife come in contact with each other on a regular basis. These interactions have rapidly devolved into regular crop-raids by the bonnet macaques in the area which has progressed to such an extent that this study was welcomed by the respondents in the hopes that some solution to the problem would be found. The growing resentment of the farmers is counter-productive to the sentiments required for the people's participation in conserving wildlife. It may eventually manifest in trapping or retaliation killing of the bonnet macaques as a result of the large economic loss sustained due to their crop raiding tendencies (Jackson & Wangchuk 2004).

METHODOLOGY

Study Area: Kerehalli hobli consists of about 14-20 villages and is located in the Hosanagara taluk of Shimoga district. The villages in this hobli are largely agriculture dependent and forest cover is vast, having more than three ranges that pass through it. Villages in which the study was conducted as well as houses within the villages were selected based on random sampling. Six villages from three ranges were chosen:

Hanagere Range: The Hanagere range falls under the Shimoga Wildlife Division. It is divided into 3 sections and 15 beats. Two villages were selected from this range – Batanijeddu and Kolavanka

Hosanagara Range: The Hosanagara Range is a part of the Sagar Division. It is divided into 7 sections and 22 beats. Three villages were selected from this range – Huligadde, Harathalu and Balur.

Arasalu/Ripponpet Range: The Arasalu Range (also called Ripponpet Range) comes under the Shimoga Division. One village was selected from this range – Benavalli.

Data Collection

Questionnaire survey*:* The villages and households were selected through random sampling. Each house was considered a sampling unit and formal interviews were conducted with one respondent per household. In addition, informal interviews were conducted with the rest of the members in the household and with other farmers in the area who would often gather at each sampling unit. This allowed the interviewees to elucidate on topics not covered in the questionnaire and speak about their own experience. The semi-structured questionnaire was designed to collect information on respondents.

(i) Demographic characteristics and socioeconomic status (age, gender, education, income sources, land ownership, farming experience, types of crops grown, and economic losses),
(ii) Experience of conflict (species, frequency of activity, perceived degree of crop raiding, other damage caused, aggressive behaviour, etc.),
(iii) Mitigation methods (effectiveness of measures implemented, complaints to forest officials), and
(iv) Personal opinion (reasons for conflict, attitude to the monkeys, etc.). (Mir et al., 2015; Karanth, 2007)

A separate questionnaire was also prepared for forest and wildlife officials of the three ranges wherein the respondents reside. Data was gathered from the Range Forest Officers (RFO) of the respective ranges, as well as the Forest Guards (FG) who patrol the beats in which the villages are located. The unstructured questionnaire was designed to collect information from an official perspective, and included queries concerning the magnitude of the conflict, adverse effects, mitigation efforts, and many more.

Direct Observation: As a follow-up to the answers received by the respondents, direct observation of the fields in the study areas was carried out. Efforts were made to conduct the questionnaire surveys at different times of the day in order to observe primate activity first-hand. In cases of recent crop raids, fields were spot-checked and damage photographed. Different deterrent measures were noted, and new and unusual methods documented. Surroundings of the farm lands were examined to check proximity to forest areas, water bodies and adjoining fields. Reported points of entry for monkeys, as well as their resting sites were also noted. A Nikon B700 camera was used to obtain photographic evidence of observations as far as possible.

Data Analysis: Data collected was both quantitative and qualitative. Transcripts of each session were analysed for recurring themes and difference in experiences (Dixon et al. 2009). This data was either summarised or graphically represented. For close-ended questions, responses were charted and evaluated for statistical significance. Detailed notes were maintained for responses to open-ended questions. Comments were categorised and numerically coded afterwards. Certain quotations of respondents have been selected to represent unique opinions or experiences and are presented to add context to quantitative results (Ogra, 2009; Dixon et al. 2009).

RESULTS AND DISCUSSION

Data was collected from 47 respondents regarding the status of their farms, interactions with wildlife, mitigation efforts, and personal observation and experiences in relation to the bonnet macaques of the area. Of these, 13 were female and 28 were male. Ages ranged from 20 to 70 years, with the majority of the respondents falling in the 30-40 year range. About 24% of the locals interviewed received no formal education while the rest have had some level of schooling. Most of the farmers interviewed own less than 10 acres of farmland (76.19%), with only a few having more than 10 acres (23.80%). The maximum area of land owned is 27 acres, with 1 acre being the minimum. These fields are commonly surrounded by forest area and adjoining farms. The only houses in the vicinity belong to the owners of the farms. The livelihood of about 67% of the respondents depends solely on agriculture. For the rest, farming is the main occupation, but they support their income through business ventures such as shops in the town area, renting out tractors, working as helpers in local day-care centres, and the like.

Crops grown in the study area

The plantation crops grown in this region include banana, ginger, coconut, areca nut, sugarcane, rubber, paddy and maize. On a smaller scale, plants like pepper, chilly, vegetables, fruits, etc. are cultivated alongside these crops as an extra source of income. Pepper is normally grown around the trunks of areca nut, and chilly is planted along with the ginger crop as farmer's claim it does not affect the growth of the ginger, is not susceptible to disease, and does not require much maintenance. Vegetables and fruits, if not harvested to be sold in local markets, are generally grown for household use.

Conflict Situation

Reports from farmers indicate two species of monkeys that commonly raid their farms – the bonnet macaque (*Macaca radiata*) and the Hanuman langur (*Semnopithecus dussumieri*). However, incidence of Hanuman langur is much rarer (33.33%) and their visits range from once a week to once in 2 months. There were no reports of langur activity in the villages of Gavtur, Benavalli and Balur, and only one report from Harathalu. In those sites where langurs do visit farms, farmers say that they cause comparatively less damage to their crops and are not as aggressive as the bonnet macaque when being chased away. *Macaca radiata* on the other hand, enter in groups that could be as small as 10-30 or as large as 50-100 individuals. Reports of troop numbers vary from 2 to 15. This data is not accurate as it is only based on word-of-mouth. An RFO interviewed said that there would probably not be as many as 15 groups; it was more likely that the same few troops moved from area to area. Through direct observation, a macaque troop spotted in a farm in Batanijeddu consisted of around 15 individuals which confirms the observations of the farmers there. The raids begin by 6

in the morning, and increase or decrease in the afternoon depending on the place. In many cases, macaque activity tends to lessen by 5 or 7 in the evening, but some farmers report that that the troop may camp out for the night in the field itself if it gets dark.

All respondents interviewed reported damage to their crops due to monkey activity in their fields. House raids were not as common, with only a 38.09% incident rate. Infrastructure damage occurred in 14.28% of cases. Macaques rarely attacked humans (4.76%), but with dogs, attacks occurred in more than half of the instances.

Crop Damage

Although the study focuses on the man-macaque conflict, a question was also asked about the other species that cause crop damage. Problems arose from bonnet macaques in all of the cases, but the wild boar (*Sus scrofa*) – with its penchant for digging into the soil – also causes serious damage to the roots of the plants. Fig. 2 depicts the relative damage to crops cause by other animal species.

Around 30% of the people interviewed reported that half their crops were ruined due to monkey activity, with about 10% claiming that the economic loss exceeded the half-way mark, going as high as 70%. The rest experienced a less than 50% crop damage.

All interviewees concurred that the macaques waste more than they eat. They claim that of all the damage that occurs to the crop, only a quarter or less is actually eaten by the animals. The remaining is destroyed during play or fights. 8 respondents reported having changed their crops as a result of the monkey raids.

They have stopped growing crops like banana, maize, sugarcane, paddy, ragi, and coconut due to the loss incurred as a result of the macaques favouring these crops. One interviewee was so tired of having to constantly chase after the monkeys, that their entire crop of coconuts is left as it is for the monkeys to come and eat from them as they please. The coconuts are not being tended to, nor are they being harvested. Another respondent had to cut down all their chickoo trees as it was attracting monkeys to their farms.

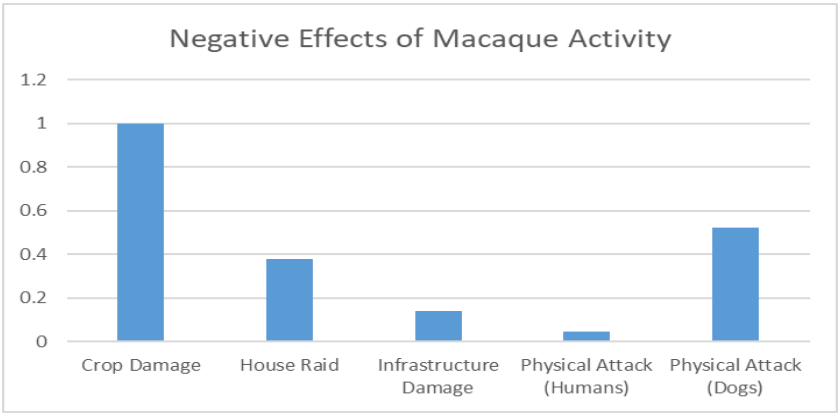

Fig. 1: Chart showing negative effects of bonnet macaque activity

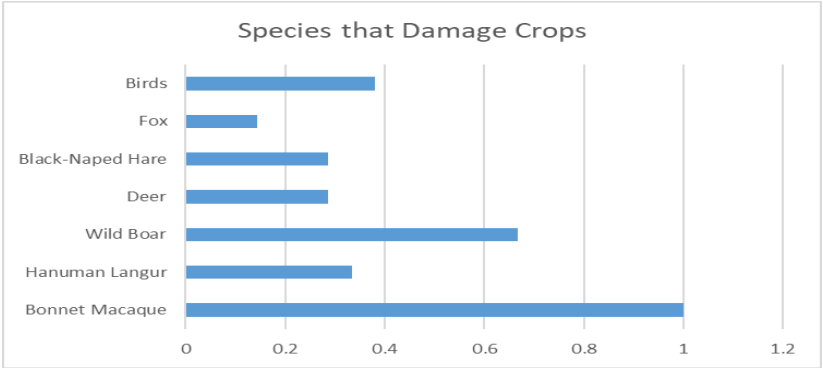

Fig. 2: Chart showing wild animal species that damage crops

Table 1: Parts of plant species eaten by monkeys

Common Name	Scientific Name	Local Name	Part Eaten
Banana	*Musa* sp.	*Baale*	Fruit, Core
Ginger	*Zingiber officinale*	*Shunti*	Tender shoot (Upto 3 months)
Coconut	*Cocos nucifera*	*Thengu*	Endosperm
Arecanut	*Areca catechu*	*Adike*	Outer fruit layer
Sugarcane	*Saccharum officinarum*	*Kabbu*	Stem
Paddy	*Oryza sativa*	*Batha*	Core, Grain
Maize	*Zea mays*	*Jowla*	Young root, Fruit (kernel)
Black pepper	*Piper nigrum*	*Kalumenasu*	Outer fruit layer
Cashew	*Anacardium occidentale*	*Godambi*	Accessory fruit
Papaya	*Carica papaya*	*Papai*	Fruit, Leaves
Vegetables		*Tarkari*	Fruit

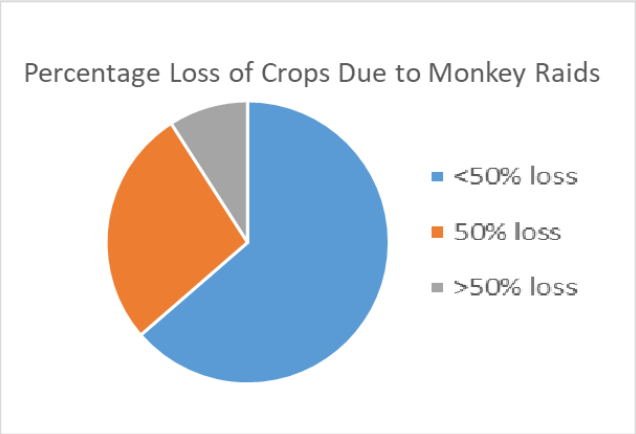

Fig. 3: Pie chart depicting percentage loss of crops due to monkey raids

House Raids

There have been reports of the monkeys ransacking houses when people are not around. They remove the tiles and come in through the roof, or enter through any open door. Vegetables, fruits and other food are carried away, and vessels and other household items are found broken and strewn around the house. Said one respondent: "If no one is in the house, they enter and make a mess till evening…they eat half, they destroy half…to clean all that, we need two days."

Infrastructure Damage

There are even incidents of the monkeys breaking the PVC pipes and the smaller pipes used for drip irrigation. "Day before yesterday, I set up the pipes. [The monkeys] came and played with them, so I buried them under the soil…they sit where the water comes out and after drinking, they jump on the pipes." One farmer said that they had to check the pipes daily to make sure they were still in place.

Aggressive Behaviour

Except for a few cases, many of the people interviewed said that they have experienced aggressive behaviour from macaques. Once up in the safety of a tree, they bare their teeth and make threatening gestures in response to being provoked. They also appear to be less afraid of women than men, with several of the respondents observing that they refuse to run when women try to chase them away. None of the farmers report being attacked first hand, but they did report scattered instances of monkeys biting people if they react violently towards them. The bonnet macaques are generally afraid of dogs, but there have been cases of them surrounding and attacking a single dog if there are no humans around. They may even tease the dogs by jumping down from, and climbing up the same tree several times.

Mitigation Methods:

As a result of the conflict situation, farmers have come up with several techniques to keep monkeys from raiding their crops. Of these, the most commonly employed measure is the use of dogs (90.47%). At least one dog was observed in nearly every household. Nets or fencing (85.71%) and/or Ibex fences (66.66%) are set up by all respondents as they serve the dual purpose of keeping animals away and acting as a boundary. The other methods of chasing away monkeys involve use of stones and loud sounds. Guns are the least common, owned by only 19.04% of the respondents.

Owing to the rapidly evolving intellect of the macaques, it is difficult to find a suitable method to prevent them from entering farms. Any measures implemented therefore, must be in driving them away after their entry into the fields, or on having spotted them on the

boundaries of the farm land. The alpha of the troop keeps watch from the sanctuary of the tree cover, and checks to see if there are any humans around. If the coast is clear, he signals the rest of the troop and they make their way into the field so quietly, that they are not detected until they begin raiding the crop, at which point they create a racket while fighting for the food. The macaques stay as close as possible to trees as they are not quick on the ground. On being chased, they immediately scale a tree and leap from branch to branch back into the forest. The bolder ones however, climb up a tree and stare down at the human.

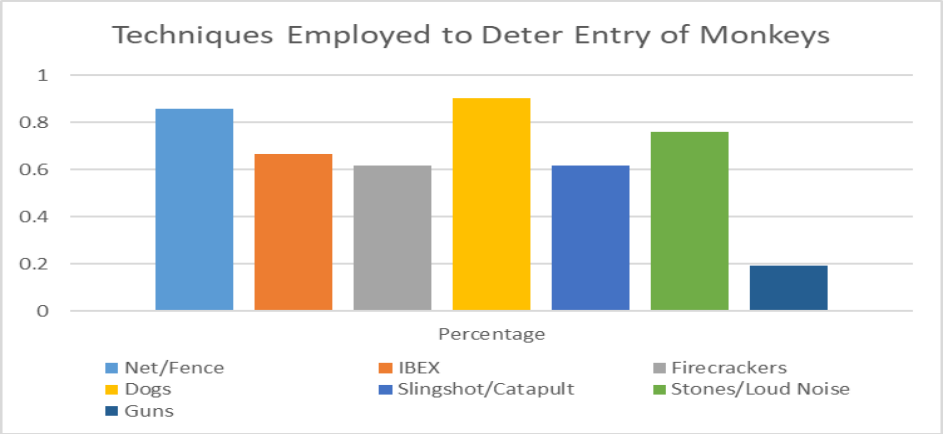

Fig. 04: Chart showing techniques employed to deter entry of monkeys into farms

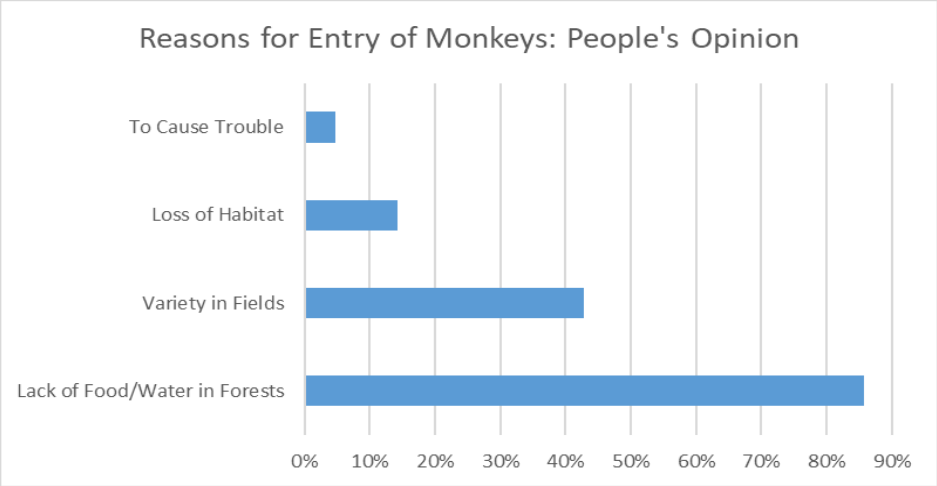

Fig. 05: Chart showing respondents' opinion for the entry of monkeys

Possible Causes for the Conflict

To determine the possible cause for the entry of pest primates into the farms, opinions were asked of the interviewees, and their responses have been broadly grouped into four categories. Most of the respondents felt that the lack of food and water in the forests leads the macaques to enter human habitations in search of the same. In their opinion, the reason for this shortage is the loss of natural fruit-yielding trees in the forest over the past decade, and reforestation with trees like *Acacia* and *Nilgiri* which the locals are not even allowed to harvest. On the other hand, the belief of about 43% of the respondents is that the presence of food in the forests is irrelevant; what draws the macaques to the fields is the variety available. This is another valid explanation as the monkeys show preference to certain food crops like maize and papaya. Crops like ginger and pepper are eaten only if other better-tasting plants are not available. A few (14.28%) said that the loss of their habitat is driving the animals out of the forests. The diminishing number of trees leads them to the edge of the forests and thereby, the farm lands more easily. One respondent was of the firm conviction that the monkeys did not enter his fields for any of the above reasons, but because they want to cause trouble. This is because the bonnet macaques eat only about a tenth of the crop they

damage. The rest is destroyed during play or fights. They enter his house through the front door and more than stealing the food, they break and throw household items around.

Official Perspective

The study was conducted in villages belonging to 3 ranges – one wildlife range (Hanagere Range) and two forest ranges (Arasalu and Hosanagara Ranges). All three departments that manage these ranges receive complaints regarding the macaques, both formal and informal, though the officials in Arasalu felt that the problem is not as serious in their area. Complaints are also given about the wild boars, which burrow into the soil and damage the roots. The department inspects the site to verify the claims, after which the written complaints are forwarded to the respective Divisional Forest Officer (DFO) for compensation. However, compensation is rarely if ever awarded to complainants of monkey conflict. The reason given was that that the bonnet macaque is not a scheduled animal. Even if compensation is awarded, the amount may be a few thousands per hectare, which is not equal to the damage caused. Instead, forest guards can only advise farmers on how to chase away macaques and some departments conduct occasional awareness programmes on forest fires and managing conflict with wildlife. Guns are not permitted, although airguns can be used. Other weapons require a permit from the Superintendent of Police, which is only granted if the land is 10 km away from forest area.

No populations surveys have been conducted, but officers concur that the primate population is definitely on the rise. In addition to the increasing number of individuals, the encroachment occurring on forest land for the purpose of expanding agricultural fields is resulting in a loss of habitat for the animals. Taking advantage of the Forest Right Act -2006, people are moving further into forests in the hopes of acquiring the rights to that land. The fruit-yielding trees that used to grow in plenty in the past, are now becoming rarer due to deforestation for firewood, houses, fencing, etc. Uncontrolled grazing is another reason for the destruction of habitat. All this has led to a shortage of resources, which is driving the monkeys out of the forests and into human habitations.

However, the people cannot be blamed entirely for their actions. Based on information gathered from the forest officials, it was discovered that many of the inhabitants in the area are Sharavathi and Linganmakki dam refugees that have been relocated by the government and allocated land which has, as yet, not been properly denotified, i.e. their land is not *khathe*. This land cannot claim compensation as it is essentially classified as encroached land. In addition, about 30-50 years ago large areas of forest land were cleared for the purpose of planting Acacia and Nilgiri sp. which were to be sold to the Mysore Paper Mills (MPM) as raw material. Only certain areas are tendered for collection by locals.

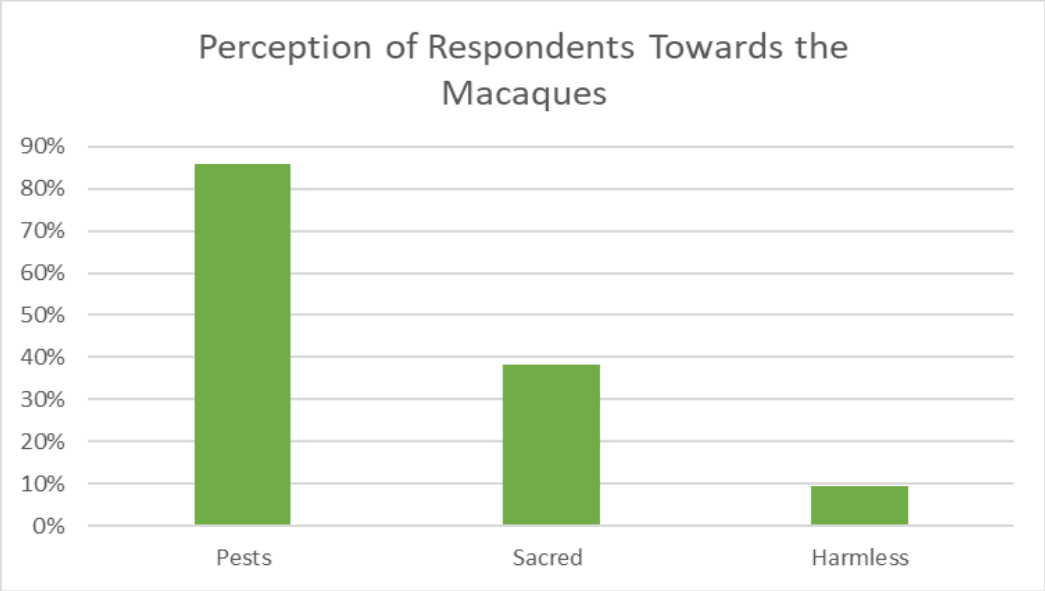

Fig. 06: Chart showing perception of respondents towards the macaques

The RFOs interviewed said that the government has long since banned the planting of *Nilgiri* trees as it absorbs all the nutrients from the soil. The *Acacia* trees were initially used for restoration of forests as it is a hardy species and comes up fast, and would also meet the immediate need for timber and fuel wood. However, reforestation with this species has recently been stopped by government diction as the trees are dominant and absorb much of the water from the soil, preventing other plants from growing around it. At present, natural fruiting trees and shrubs are being planted instead, like *Artocarpus heterophyllus*, *Syzygium* sp., *Terminalia* sp., *Dalbergia latifolia*, *Pterocarpus marsupium*, bamboo species, and more. Officials suggest other measures that could be implemented like reducing encroachment, rehabilitation centres and castration for monkeys, and creating awareness among the people. However, they say, these methods may not be feasible and are bound to be time-consuming.

Overall Opinion:

Approximately 86% of the respondents viewed the macaques as pests, and about 38% considered them to be sacred. Most of the people in this group had a mixed opinion of the monkeys, considering them to be god, but the loss they incur leading them to believe they are also pests. Very few of the people interviewed (9%) felt that the monkeys were harmless and that the issue was manageable on their farms.

The people interviewed found no benefit to the monkey's presence in the area, although one respondent did say that by chewing on the outer fruit coat of the areca nut and throwing the seeds down no harm came to the crop, and in fact helped in propagation or in seed collection. However, the respondent also conceded that the damage they caused in the initial stages of the areca nut plantations far outweighed any benefit they might have on the crop later on. The major source of crop damage differs depending on the area. A majority reported monkeys as a major source of damage, but in areas where there is a scarcity of water, the inability to properly irrigate the crops poses more of a threat than macaques. The wild boar was also cited as a reason in certain areas owing to their fondness for maize and their tendency to mow down the plants and eat the cobs. 25% of the respondents felt that disease was another primary factor that resulted in spoilage of crops, but as one farmer put it, he did not know how much of the disease was natural and how much was brought in by the monkeys. Lack of electricity was another reason given as without it, water could not be pumped through the pipes for irrigation of the fields.

DISCUSSION

Naughton-Treves et al. 1998 studied the crop-raiding patterns of primate species in fields around African parks and reserves and found that a preference was shown to maize and bananas. This correlates with the respondents' claims that maize is a favourite of the macaques. Severe damage was also witnessed to the banana crop, but it has been discovered that the bananas are ignored if papaya or watermelon is grown next to it. This provides strong evidence for the success of buffer zones. However, as it is difficult for individual farmers to allocate land towards less desirable crops, the venture should be government-funded. Another observation made by Naughton-Treves et al. 1998 as well as the Baranga et al. (2012), is that the closer a farm is to the forest, the greater the chance of macaques raiding the fields. In the present study, nearly all farms were in some proximity to the forest edge, considering the large number of reserve and state forests within the hobli, but it was noted that those agricultural lands with forest cover on at least one side experienced more crop damage than fields adjoined solely by neighbouring farms. This could lead to clearance of forests around farm lands, which would result in further destruction of the natural habitat. Although the question regarding cutting down of trees or setting fires was asked of the respondents, it is unlikely that they would answer in the affirmative. However, steps should be taken by the government before the problem worsens, especially considering the rising population.

Similar observation made by Dutta et al. (2015), find monkeys to be one of the reasons due to which conflict arises. This study was conducted in the forest villages of Barak Valley, Assam, and it was found that crop-raiding by the Rhesus macaque (*Macaca mulatta*) was a serious problem in the area. In fact, much of the literature involving monkeys surrounds their crop-raiding tendencies. Ahsan & Uddin (2014), Das and Mandal (2015), Regmi et al. (2013), Kumar et al. (2003), Kurup (1992), Rai et al. (2015), Devi and Saikia (2008) documented this situation in different parts of India and it was found that although the monkeys enter residential areas and show aggression towards humans, damage to agricultural crops was one of the major reasons for conflict in the region.

Some respondents also claimed that the monkeys that were from the town areas caused more problems than those who had spent their whole lives in the forest. This concept of "urbanized" monkeys, who are more habituated to human presence and therefore, less afraid was noted by Yeo & Neo (2010). The same study also found that attacks on women and children were more likely to occur than on men. This has been noted in the present study as well, with interviewees reporting that macaques rarely run when chased by women, and in the case of children, show aggression. This however, does not affect employability of females in the area.

Perceptions of the local people regarding the wildlife in the area is important in determining whether the situation qualifies as a conflict issue. Lee & Priston (2005) stress this point concerning attitudes towards primates and mitigation strategies. At present, the viewpoints of the respondents in their study sites are at odds. On one hand, the monkey is a revered creature in the Hindu religion. On the other hand, the destruction and economic loss they cause cannot be excused as divine interference. Yet, some are reluctant to classify the macaques as pests in light of their faith. They are angry at the loss they face, but they refuse to harm the monkeys for fear of being cursed. For others, the answer is clear. As one farmer put it: "God is god. These monkeys are just animals. What can we do if they destroy our crops?"

CONCLUSION

Although several mitigation strategies have been described by Treves et al. (2017); Lee & Priston, (2005), the quick learning and adaptive ability of primate species make it nearly impossible to find a method that works permanently. People are required to constantly invent new and unusual measures to outsmart these monkeys. It is interesting to note that, at times, the most innovative ideas encountered in this study have come from those respondents who have had incomplete or no formal education.

Then again, the people alone cannot take care of this issue. When asked what could be done about the monkeys, the prevailing response was that there is no solution and that they have to live with it. However, crops ruined due to disease as well as a lack of water in certain areas combined with the regular raids on their crops is increasing levels of frustration among the people. Many feel that that the government or the forest department should do something to help reduce the problem. Contrary to expectations, there was barely any talk of financial compensation; all they require is some sort of solution. The attitude of the locals to the macaques is not so drastic that they want to cause harm to the creatures, but indifference towards the issue in light of increasing macaque populations will worsen relations between man and animal until it gets to the point where the sacred status of the monkey will not be enough to protect it from harm.

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